



PATENT

## IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant : Raymond J. Beach et al.

Attorney Docket: IL-10571

Serial No. : 09/651,658

Art Unit: 2828

Filed : August 29, 2000

Examiner: C. Jackson

For : Tapered Laser Rods As A Means  
Of Minimizing The Path Length Of  
Trapped Barrel Mode RaysDECLARATION UNDER 37 CFR §1.132

Commissioner for Patents

P.O. Box 1450

Alexandria, VA 22313-1450

Dear Sir:

I, Raymond J. Beach, hereby declare that I am a citizen of the United States of America and a resident of Livermore, California.

I have a PhD in physics from Columbia University.

I am a Physicist with the University of California, Lawrence Livermore National Laboratory at Livermore, California.

I have worked in the laser field at Lawrence Livermore National Laboratory for 16 years.

I have read the office action and would like the examiner to consider my comments in response to the rejections of claims 1-20 as being obvious.

Claims 1-3, 5-8, 11-18 and 20 are rejected as being unpatentable over Meissner et al. (5936984) in view of Peressini (6418156). The rejection is respectfully traversed.

The Meissner patent (US 5,936,984) discloses a laser rod design with a polished barrel, which is a feature common to our invention. However, the Meissner patent only has a taper or flange on the undoped portion of the laser rod near the laser rod's two ends, while our invention explicitly claims a taper over the entire doped length of the laser rod, central part as well as ends.

The Peressini patent (US 6,418,156 B1) does have a figure of a laser rod tapered along its length in its discussion (Fig. 11); however the reason for doing this is entirely unrelated to parasitic suppression (the reason we invoke tapered laser rods in our patent application). In the Peressini patent the reason for the taper on the various laser gain elements described, is to maximize the path length of the pump rays within the gain medium, which can be advantageous for some specific classes of laser as it permits lower doping densities of lasant ions to be effectively utilized. There are two major differences between the structures claimed by Peressini and those claimed by ourselves:

1. The structures in the Peressini patent are all constructed so that the pump radiation is introduced into the gain medium in a direction transverse to the laser axis, whereas our tapered laser rods are all constructed so that the pump radiation is introduced substantially parallel to the laser axis.

2. The structures in the Peressini patent control ASE and parasitics through the use of special optical coatings on the transverse sides of their gain elements. Throughout the discussion in the Peressini patent it is emphasized that the purpose of the coatings is two fold. The coatings are intended to either absorb or efficiently

out couple ASE from the laser gain media, as well as confine the pump radiation to the laser rod via high efficiency reflection. "In order to insure effective and efficient laser operation, the integrated pump cavity described herein includes special coatings that work individually and cooperatively with the cavity design to dampen ASE and suppress parasitic mode oscillation while still being reflective to the optical pump radiation." See column 17, lines 18-24. On the other hand, our laser rods are specifically uncoated on their transverse side, and instead efficiently transport ASE from the laser rod where it develops to the ends of the laser rod where the ASE is quenched in the endcaps. See, e.g., page 2, lines 9-11. Claims 1, 12 and 16 have been amended to clarify that the laser rods are uncoated. Therefore the rejection should be withdrawn.

Claims 4, 9, 10 and 19 are rejected as being unpatentable over Meissner et al. (5936984) and Peressini (6418156) as applied to claims 1-3, 5-8, 11-18 and 20 above, and further in view of Tang (6263007). The rejection is respectfully traversed.

The rejection should be withdrawn because claims 4, 9 and 10 depend from independent claim 1 and claim 19 depends from independent claim 16, which should be allowable as discussed above.

Further, the Tang patent (US 6,263,007 B1) contains a diagram showing a tapered gain volume (Fig. 9), but this is unrelated to our tapered laser rod. The most important difference between the tapered gain volume in the Tang patent and our tapered laser rod is that the tapered region in the Tang patent is a low refractive

index region (near unity, containing a gaseous medium), while the surrounding medium does not even have to be optically transparent at the laser wavelength. In our tapered laser rod, the rod itself has to have higher refractive index than the surrounding medium, and the surrounding medium (typically cooling water or air) is also required to be optically transparent at both the pump and the laser wavelengths. The reason for the tapers in the Tang patent are to pinch down the optical cavity so as to only permit lasing to occur in the fundamental (or  $TEM_{0,0}$ ) mode - a technique known as spatial filtering in the laser scientific and technical literature. There is no connection between ASE and parasitic management and the use of tapered laser regions in the Tang patent.

Therefore the rejection should be withdrawn.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Respectfully submitted,

Raymond J. Beach  
Raymond J. Beach

Dated: October 14, 2003